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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* FREDRIK LINDQVIST, ANTONI FERTNER,  
and PAL FRENGERT

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Appeal 2009-001682  
Application 09/584,796  
Technology Center 2600

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Decided:<sup>1</sup> June 29, 2009

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Before JOSEPH F. RUGGIERO, MAHSHID D. SAADAT, and ROBERT  
E. NAPPI, *Administrative Patent Judges*.

NAPPI, *Administrative Patent Judge*.

DECISION ON APPEAL

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<sup>1</sup> The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

This is a decision on appeal under 35 U.S.C. § 6(b) of the rejection of claims 1, 3 through 7, 9 through 28 and 30 through 44.

We reverse.

## INVENTION

The invention is directed towards a method for use in multicarrier communications systems. The method is directed to reducing echo when a transmitted signal leaks back to a receiver. See page 1 and 2 of Appellants' Specification. Claim 1 is reproduced below:

1. An echo canceller for use in a transceiver, comprising:  
first electronic circuitry configured to estimate in the frequency domain an echo signal, and  
second electronic circuitry configured to remove in the frequency domain the estimated echo signal in the frequency domain from a received signal in the frequency domain,  
wherein the first electronic circuitry is further configured to estimate the echo signals in the frequency domain using a combination of (i) a product of a first matrix of coefficients in the frequency domain and a transmitted symbol and (ii) a product of a second matrix of coefficients in the frequency domain and a previously-transmitted symbol.

## REFERENCES

Chaffee	US 5,117,418	May 26, 1992
Ho	US 5,317,596	May 31, 1994
Dowling	US 6,597,745 B1	Jul. 22, 2003

## REJECTIONS AT ISSUE

The Examiner has rejected claims 1, 3 through 7, 9 through 17, 20 through 28, and 30 through 43 under 35 U.S.C. § 103(a) as being

unpatentable over Ho in view of Dowling. The Examiner's rejection is on pages 4 through 7 of the Answer.<sup>2</sup>

The Examiner has rejected claims 18, 19, and 44 under 35 U.S.C. § 103(a) as being unpatentable over Chaffee in view of Dowling. The Examiner's rejection is on pages 7 through 9 of the Answer.

## ISSUES

### *Obviousness rejection based upon Ho and Dowling.*

Appellants argue on pages 17 through 24 of the Brief<sup>3</sup> that the Examiner's rejection of independent claims 1, 12, 20, 30, and 35 under 35 U.S.C. § 103(a) as being unpatentable over Ho and Dowling is in error. Appellants state that each of independent claims 1, 12, 20, 30, and 35 recites estimating and removing echo in the frequency domain and that the combination of Ho and Dowling does not teach this feature. Appellants argue that Ho primarily cancels echo in the time domain and residual echo is removed in the frequency domain. Brief 17. Appellants further argue that Dowling does not teach estimating and removing an echo signal from a received signal in the frequency domain. Brief 18.

Thus, Appellants' contentions present us with the issue: have Appellants shown that the Examiner erred in finding that the combination of Ho and Dowling teaches estimating and removing an echo signal as claimed?

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<sup>2</sup> Throughout the opinion we refer to the Answer mailed February 27, 2008.

<sup>3</sup> Throughout the opinion we refer to the corrected Brief dated January 2, 2008, Reply Brief, dated February 15, 2007 and the Supplemental Reply Brief dated May 18, 2007.

*Obviousness rejection based upon Chaffee and Dowling.*

Appellants argue on pages 24 through 30 of the Brief that the Examiner's rejection of claims 18, 19, and 44 under 35 U.S.C. § 103(a) as being unpatentable over Chaffee and Dowling is in error. Appellants state that claims 18 and 19 recite estimating echo in the frequency domain based upon a product of a matrix (claim 19 recites a vector) and the currently transmitted symbol, and a matrix (vector) and a previously transmitted symbol. Appellants argue that Chaffee does not teach this feature and that Dowling teaches a precoder for transmission channel distortion and not echo estimation as claimed.

Thus, Appellants' contentions present us with the issue: have Appellants shown that the Examiner erred in finding that the combination of Chaffee and Dowling teaches estimating and removing an echo signal as claimed?

PRINCIPLES OF LAW

Section 103 forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

*KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 405 (2007).

Such a showing requires:

'some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness' . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

*Id.* at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Therefore, in analyzing a rejection under 35 U.S.C. § 103, we must “determine whether there was an apparent reason to combine the known elements in the fashion claimed.” *KSR*, 550 U.S. at 418. The proper inquiry is whether a person of ordinary skill in the art would have seen a benefit to combining the prior art teachings. *KSR*, 550 U.S. at 424.

The evidence of record is insufficient to show obviousness if it merely suggests “to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.” *In re O’Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

Further, a rejection based on § 103 must rest upon a factual basis rather than conjecture or speculation. “Where the legal conclusion [of obviousness] is not supported by the facts it cannot stand.” *In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967). *See also In re Kahn*, 441 F.3d at 988.

## FINDINGS OF FACT

1. Ho teaches a method for echo cancellation in a full duplex communication system. The method makes use of frequency domain echo parameters and time domain echo parameters to produce a frequency domain echo. The frequency domain echo is converted to a time domain echo and subtracted from the time domain received signal. The time domain received signal, with the time domain echo subtracted is then converted to the frequency domain and the frequency domain echo is also subtracted. Abstract, col. 4, ll. 30-53.

2. Ho teaches that the circuit for a transceiver which implements the method includes an encoder, item 12, and an inverse fast fourier transform (IFFT) item 14, on the transmit leg. The receiving leg includes two summing junctions, items 52 and 58, and a fast fourier transform (FFT) item 56. Between the two legs is an echo canceller which receives inputs from either side of the IFFT on the transit leg (i.e. inputs in frequency domain and time domain). These inputs are processed to emulate and produce an echo component. The echo canceller provides outputs to each of the summers in the receiver leg (i.e. output is summed with the received signal in the time domain and frequency domain) to subtract out the emulated echo and produce an echo free reception. Figure 3, col. 5, l. 65- col. 6, l. 22.
3. Dowling teaches a precoder which compensates for effects of intersymbol interference in multicarrier systems. Col. 1, ll. 7-13.
4. Dowling suggests that the precoder may be merged with other elements of communications systems such as echo cancellers. However, Dowling provides no details of how the two are to be merged. Col. 22, ll. 1-6.
5. Chaffee teaches a system for reducing echoes in a duplex communications system. The transmitted signal is converted to the frequency domain, and multiplied by filter coefficients to generate estimated echo coefficients. These echo coefficients are converted to the time domain and subtracted from the received signal to create a residual echo signal. The residual echo signal is used to update the filter coefficient. Abstract.

## ANALYSIS

### *Obviousness rejection based upon Ho and Dowling.*

Appellants' arguments have persuaded us that the Examiner erred in finding that the combination of Ho and Dowling teaches estimating and removing an echo signal as claimed.

### Claims 1, 3 through 7, 9 through 17, and 35 through 43

Independent claim 1 recites a first circuitry configured to estimate in the frequency domain an echo, and that this circuitry is "configured to estimate echo signals in the frequency domain using a combination of (i) a product of a first matrix of coefficients in the frequency domain and a transmitted symbol and (ii) a product of a second matrix of coefficients in the frequency domain and a previously-transmitted symbol." Thus, the scope of claim 1 includes that a circuit estimates echo signal in the frequency domain using both: a) a product of coefficients and a transmitted signal, and b) a product of a second set of coefficients and a previously transmitted symbol.

Independent claims 12 and 35 recite limitations of similar scope.

In rejecting independent claims 1, 12, and 35 the Examiner finds that Ho teaches an echo canceller which includes circuitry to estimate and remove echo signals in the frequency domain. Answer 5. However, the Examiner notes that Ho does not perform the estimation by using both the product of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol. The Examiner finds that Dowling teaches a precoder that compensates for noise by using a combination of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol. Answer 5. Based upon these findings the



Examiner concludes that the combination of Dowling's precoder with the encoder item 12 of Ho would yield the claimed invention. Answer 10. We disagree with the Examiner's conclusion.

Dowling's precoder is used to precode data for transmission; the precoding is to compensate for inter-symbol interference in a transmission channel. Fact 3. While Dowling discloses that the precoder can be used with echo cancellers, Dowling provides no insight as to how the precoder is to be used with such systems. Fact 4. Further, Dowling does not teach that the calculations which use a combination of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol are used for echo estimation or cancellation. Thus, even if as found by the Examiner, Dowling's precoder were used for Ho's encoder item 12, the echo canceller item 100, would be using the precoded signal to perform the estimation of echo, which does not meet the claim limitation of using a combination of a first matrix and first symbol, and the product of a second matrix as a previously transmitted symbol, for echo estimation or cancellation. Accordingly, we will not sustain the Examiner's rejection of independent claims 1, 12, and 35 under 35 U.S.C. § 103(a) as being unpatentable over Ho in view of Dowling. Claims 3 through 7, 9 through 11, 13 through 17 and 36 through 43 ultimately depend upon one of independent claims 1, 12, and 35. Thus, we similarly will not sustain the Examiner's rejection of claims 3 through 7, 9 through 11, 13 through 17, and 36 through 43 under 35 U.S.C. § 103(a) as being unpatentable over Ho in view of Dowling.

Claims 20 through 28 and 30 through 34.

Independent claim 20 differs in scope from independent claims 1, 12, and 35 discussed above in that it does not recite estimating echo signals using transmitted and previously transmitted signals. Rather, independent claim 20 recites an echo canceller in a transceiver that uses a frequency domain model of an echo path channel that takes into account the effects of inter-carrier interference and to subtract the echo estimate from the received signal. Independent claim 30 recites using a frequency domain model of an echo path channel that includes the effects of inter-carrier interference and inter-symbol interference, to subtract the echo estimate from the received signal.

In rejecting claims 20 and 30, the Examiner applies the same rationale discussed above with respect to claim 1 and finds that Dowling discloses that the precoder takes into account the effects of inter-carrier interference (ICI). Answer 6. Further, the Examiner finds that the echo path is directly based on the transmission channel as the transmission channel provides the impedance mismatch which causes the echo. Answer 15. We disagree with the Examiner's rationale. As discussed above, Dowling discloses that the precoder can be used with echo cancellers, however, Dowling provides no insight as to how the precoder is to be used with such systems. Fact 4. Further, Dowling does not teach that the calculations are directed to inter-symbol or inter-carrier interference that are used for echo estimation or cancellation. Thus, we do not find sufficient evidence to support the Examiner's conclusion that Dowling in combination with Ho teaches using a frequency domain model of an echo path channel that includes inter-carrier or inter-symbol interference, as recited in independent claims 20 and 30.

Claims 21 through 28 and 31 through 34 ultimately depend upon one of claims 20 and 30. Accordingly, we will not sustain the Examiner's rejection of claims 20 through 28 and 30 through 34 under 35 U.S.C. § 103(a) as being unpatentable over Ho in view of Dowling.

*Obviousness rejection based upon Chaffee and Dowling*

Claims 18 and 19

Appellants' arguments have persuaded us that the Examiner erred in finding that the combination of Chaffee and Dowling teaches estimating and removing an echo signal as recited in claims 18 and 19. Claim 18 recites circuitry which uses a combination of the product of a first matrix and a transmitted symbol and the product of a second matrix and a previously transmitted symbol to estimate an echo signal in the frequency domain and to remove the echo in the time domain. Claim 19 recites a similar limitation, with the exception of the product being between a vector and symbol.

In rejecting these claims the Examiner finds that Chaffee teaches an echo canceller which includes circuitry to estimate and remove echo signals in the frequency domain and remove them in the time domain. Answer 7. However, the Examiner notes that Chaffee does not perform the estimation by using both the product of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol. The Examiner finds that Dowling teaches a precoder that compensates for noise by using a combination of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol. Answer 5. Based upon these findings, the Examiner concludes that the combination of Dowling's

precoder and the echo canceller of Chaffee would yield the claimed invention. Answer 10. We disagree with the Examiner's conclusion.

As discussed above with respect to claim 1, Dowling discloses that the precoder can be used with echo cancellers; however, Dowling provides no insight as to how the precoder is to be used with such systems. Fact 4. Further, Dowling does not teach that the calculations which use a combination of a first matrix and first symbol, and the product of a second matrix and a previously transmitted symbol are used for echo estimation or cancellation. Thus, we do not find that the Examiner has shown that all of the limitations of independent claims 18 and 19 are taught by the combination of Chaffee and Dowling and we will not sustain the Examiner's rejection of claims 18 and 19 under 35 U.S.C. § 103(a).

#### Claim 44

On page 9 of the Answer the Examiner rejects dependent claim 44 under 35 U.S.C. § 103(a) as being unpatentable over Chaffee and Dowling. The Examiner states that the rejection is based, in part, upon the rejection of claim 35 based upon Chaffee. However, no rejection of claim 35 based upon Chaffee is before us. Nonetheless, as discussed above we will not sustain the Examiner's rejection of claim 35 under 35 U.S.C. § 103(a) based upon the teachings of Ho and Dowling. Similarly, as discussed with respect to claims 18 and 19, we do not find that the teachings of Chaffee provide a teaching of the features not taught by the combination of Ho and Dowling. Accordingly, we will not sustain the Examiner's rejection of claim 44.

ORDER

The decision of the Examiner to reject claims 1, 3 through 7, 9 through 28 and 30 through 44 is reversed.

REVERSED

ELD

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